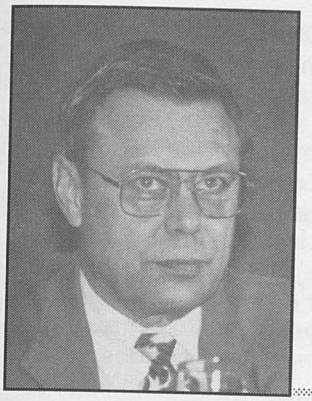

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MORNING SESSION
Thursday, September 5, 1991

Leon Larson, Administrator, Region 4
Federal Highway Administration

FHWA—RESEARCH AND TECHNOLOGY PROGRAM—WHAT'S NEW?

It is a pleasure to attend your Annual Transportation Forum and discuss transportation innovations and new directions for the '90s. The interstate era is ending and a new era is beginning. The future will be exciting for all in the transportation industry.

Over the last several decades we, as a nation, have spent considerable resources constructing our highway system. But that system gets older every day and must be maintained. In spite of all we have done, we still have congestion problems and it seems that no matter what we build or how well we design and construct facilities, we still have a difficult time keeping up with demand. When we review past highway programs, it becomes clear that as a nation we must begin to get more for our resources. The emphasis during this post-interstate period will be on efficiency and safety. We have been improving safety on the system, but 46,000 deaths per year is too many.

In 1990, the Department of Transportation, under the leadership of Secretary Samuel K. Skinner, completed a National Transportation Policy and it was endorsed by President Bush. A major theme from that policy is to "Advance U.S. transportation technology and expertise for the twenty-first century." Other statements in that policy include: "We need to focus on innovation and technology to fulfill national transportation goals of safety and efficiency and meet the transportation needs of the future." And, the United States must "...Foster innovation through

transportation research and development." Research is the key to finding innovations for improvements and right now we have a very favorable climate for research activities.

In the spirit of this theme, we are planing a major research and technology deployment effort with an expanded commitment in fundamental R&D, materials and methods, and Intelligent Vehicle/Highway Systems (IVHS) in a new public/private partnership. We intend to expand our Turner-Fairbank Highway Research Center. This involves additional staff, new skills, and additional opportunities for advanced education. We plan to refurbish our facilities and provide new programs to share laboratory space and to provide for trading staff with universities, private organizations, and other countries.

Within the FHWA we are eager to proceed with this additional focus on research and technology. We are expecting an increase in funding for research and development. In the development area, we have reorganized to reduce fragmentation in our organization and to maximize effectiveness. I'm not going to go into detailed organizational charts but the end result is that we will have one office responsible for demonstrating new technology, providing implementation materials, dealing with evaluation of experimental features, and providing technology transfer to local agencies. That office is the Office of Technology Applications. We believe this organization will be a tremendous aid in our efforts to identify, evaluate, refine, package, and deliver innovative technology to the users.

Our new Office of Technology also will be involved in implementing new products expected from the Strategic Highway Research Program (SHRP). SHRP is a $150-million, 5-year research program congressionally established in 1987. All of its projects will be completed in March 1993. We expect many new items of technology from this program and actually about 95 new procedures and products have already been identified.

To plan for our research efforts, we are making adjustments in our procedures to increase the role of states and the private sector in identifying, contributing to, and strengthening FHWA research and technology efforts. Adjustments are being made to the traditional AASHTO and TRB input processes and we are making new contacts with private organizations. New procedures will provide for improved input and quality feedback for our programs. They also will assure relevancy of our efforts and give the transportation industry more confidence in our programs. Communications between technology users and providers will be enhanced.

FHWA Research Emphasis Areas

Major critical national issues on which we will be concentrating include safety, structures, pavements, technical training, congestion, and mobility.

Critical National Issue: Highway Safety

As I noted earlier, 46,000 deaths per year is too many, so are 1.7 million disabling injuries. The dollar costs of all this is staggering, with estimated comprehensive crash costs of $339 billion.

Principal highway safety issues include:

- Work zone fatalities have increased 60 percent in seven years
- Night accident rate is triple the day rate
- Accidents double during congestion and are four times more likely to occur during adverse weather
- Drivers over 65 are twice as likely to be involved in a crash as middle-aged drivers, and the number of drivers over 65 is increasing
- Need to enhance highway safety design process
- Pedestrians account for 15 percent of highway deaths
- Design criteria are needed to accommodate larger trucks
- Roadway-based safety data system is the key to assessing highway operation and design problems

We certainly need to address these issues.

Critical National Issue: Highway Structures

In the area of structures, we have 577,710 structures in the nation that are over 20 feet in length. Of these, 238,357 are deficient. Of these deficient structures, 135,826 are structurally deficient (meaning they have structural problems) are probably posted, and can still be useful with proper enforcement of posting.

The other 102,531 are functionally obsolete, meaning the design is such that they no longer provide adequate service to current traffic demands.

These deficiencies can be corrected for about $51 billion, but structures age every day and while these deficiencies are being corrected additional structures are becoming deficient.

New innovative methods to design, construct, protect, and rehabilitate structures should provide large dividends.

Critical National Issue: Highway Pavements

Another critical national issue is, obviously, pavements. There are 3.87 million miles in the U.S.; 850,000 miles are on the federal-aid system. We travel two trillion miles on the roads each year and 75-80 percent of freight transportation, based on dollar value, is done on our highways. As a nation, we spend $68 billion annually on pavements. It doesn't take much imagination to see how beneficial cost-reducing improvements would be for pavement design, construction, protection, and rehabilitation.

Critical National Issue: Technical Training

The need for technical training has become a critical national issue. Highway agencies must build tomorrow's work force from a population where there is a 25-percent annual student dropout rate and 23 million Americans are functionally illiterate. Skills needed in highway agencies are changing. Retirements and people with new skills are changing the work force. By the year 2000, nearly one third of the jobs will require a college education and there will be a 36-percent increase in demand for scientific and technical people. The Wall Street Journal has indicated that we need to retrain every 10 years for new technology. Increased efforts will be needed to deal with this issue.

Critical National Issue: Highway Congestion/Mobility

Another critical national issue is highway congestion and mobility. This is an exciting new area and I will discuss this issue in more detail, with a focus on applying advanced transportation technologies as one possible solution. With the good work of Jerry Lentz and others from the Kentucky Transportation Cabinet and Calvin Grayson and his staff at the Kentucky Transportation Center, you in Kentucky have some real national leaders in the application of higher technology in the highway environment, or Intelligence Vehicle/Highway Systems as we have all come to call it. Your Advantage I-75 project will be one of the first of the commercial vehicle projects in the country that will begin to produce tangible benefits for us all, possibly as early as one year from today. (We'll discuss this in more detail later.)

To begin, I will discuss the nature of our very pervasive congestion problem and some of the key issues which push us in the direction of IVHS:

- Traffic congestion tops the list of public concerns in surveys at both the national and local level. The problem of congested highways is truly a "quality of life" issue. Congestion tops the list, surprisingly, over such issues as crime, drugs, and poverty. Although, here in the southeast, we currently do not have the degree of problems encountered elsewhere in the United States. This probably only means that we have a few more years of lead time in which to be pro-active in formulating solutions.

- Traffic jams cost us each over $300 per year in lost time and lost productivity.

- As traffic grows, so will the time lost in traffic jams. You may have heard of the FHWA study that projected congestion delays in the year 2005. Because of our phenomenal growth in the southeast, a number of our cities rise to the top of this listing.

- It has been estimated that each of us pays an additional $200 per year just in the time lost from poor route choices. We do not have enough current and pertinent information as drivers to make the route choice (or mode choice) that would minimize our travel costs.

- States and the motor carrier industry are spending *billions* of dollars on the regulation of the industry in the forms of licenses, permits, fees, weighing, and inspection.

- Finally, a majority of commercial vehicle accidents are attributed to driver error, and these vehicles are several times more likely to involve fatalities than are accidents where only automobiles are involved.

IVHS High-Priority Areas

During the next several years, we are concentrating on the following IVHS categories as areas with a high potential to be "early winners."

- Advanced Traffic Management Systems (ATMS)
- Advanced Traveler Information Systems (ATIS)
- and particularly, Commercial Vehicle Operations (CVO), for some of the reasons that I have just mentioned.

Let me speak briefly on each of these categories:

Advanced Traffic Management Systems (ATMS)

First, in the area of Advanced Traffic Management Systems, we want to be able to coordinate optimal traffic movements, especially regarding rapidly changing conditions.

- The next two years will be spent in developing some of the tools needed to analyze our proposed systems and in devising strategies for their implementation. A critical part of this effort will be the development of real-time simulation and dynamic assignment models.

- It will be critical that we face this task considering our partners in other modes, particularly with the requirements of the Clean Air Act amendments. By 1995, we hope to have developed strategies that are truly intermodal in nature.

- We anticipate that a number of real-time, area-wide surveillance systems and detection systems will come on-line by 1997. (Remember that our current traffic management systems are operating with a lag-time in the information, do not integrate local street systems, and generally are not multi-jurisdictional).

Advanced Traveler Information Systems (ATIS)

Turning now to Advanced Traveler Information Systems (ATIS), our goal is to enhance mobility and safety by providing travelers with the very best and most current information for their decision-making. This information includes route characteristics (e.g., running speed) and modal choices (for example, transit schedules and updates). I will mention a few of the highlights from a "products" list for this category:

- **On-Board Navigation Systems**. There will continue to be refinements of existing on-board navigation systems such as those included in the Pathfinder project in California and, closer to home, in the TravTek project in Orlando.

- **Real-Time Traffic Information**. The TravTek project will be one of the first area-wide systems to have segmental running speeds or "dynamic link times" broadcast in real-time.

- **On-Board Route Guidance Systems**. Again TravTek will lead the country in the operational testing of guidance systems. The TravTek methodology incorporates dead-reckoning, map-matching, and a global positioning system, with the information processing occurring on-board. We hope to have the TravTek system "debugged" by 1993.

- **Traffic Responsive Multimodal Information Systems.** As early as 1995, we hope to have traffic-responsive multimodal information systems available. These systems would allow travelers to make good modal choices based upon real-time conditions and schedule updates. A superb opportunity for demonstrating this type of technology will be the 1996 Summer Olympic Games to be held in Atlanta.

- **Real-Time Route Optimization.** By 1996, we hope to have widespread deployment of systems that have "best route" algorithms providing instantaneous responses based on current "probe" information.

- **Interactive Vehicle/Traffic Management Systems.** Our "vision" is that, by the year 2005, we will have essentially developed wholly interactive systems where information is transmitted and received by a large percentage of the traveling fleet.

Let us discuss the benefits that we can expect from this category of IVHS:

- We expect as much as a 6-percent reduction in travel distance and time amounting to savings on the order of $2 billion/year.

- A substantial amount of travel time will be saved simply through the process of making the right route choices to get by congested areas.

- When we join the previous benefits from ATMS with ATIS, we ultimately expect savings on the order of $11 billion/year.

- Of course, with the savings in travel time and avoidance of congested areas, significant reductions are expected in automobile emissions and in numbers of accidents.

Commercial Vehicle Operations (CVO)

Finally, I want to now turn to our last category, Commercial Vehicle Operations. As I said earlier, you in Kentucky have some of the recognized leaders in the United States in this area. In the short period of only about 1 year, Jerry Lentz, Calvin Grayson, and their staffs, have displayed the enormous leadership necessary to bring the Advantage I-75 to the threshold of reality, with early system design underway even as we speak. By this time next year, I look forward to hearing wonderful reports back from some of the excellent motor carrier operators that we have recruited for the test program, such as the United Parcel Service and Averitt Express.

What do we hope to accomplish in this CVO category? In the simplest terms, we want to improve our commercial fleets' productivity and safety. However, I believe that we have to go far beyond that for this subject. I believe that our successes, small and large, short-term and long-term, in the commercial vehicle operation area are crucial to the success and public acceptance of the IVHS program as a whole. With the fact that much of the technology for improving the efficiency of commercial operations is currently available, I firmly believe that CVO applications will be the "earliest" of our "early winners." Along with the current availability of the technology, CVO applications also can directly translate into real "out-of-pocket" savings for you and me as consumers. The public wants immediate benefits and we must be able to demonstrate those benefits:

> *"What would the American public have said in 1957 if we had promised our fantastic Interstate System, but had promised a total system delivery date of 34 years hence, instead of a phased delivery?"*

The answer, of course, is that we had to have pavements out there and available for public "consumption" in short order. I believe that the same case is true as we produce IVHS "products." Both Advanced Traffic Management and Traveler Information Systems have a few years to go before widespread deployment. With both of these, one "product" will be less congestion on a given route than we would have had without the system. However, if we still experience some congestion, it is hard to be satisfied with the fact that it is an incremental amount less. On the other hand, it is much easier for me to see the tie between pre-clearing carriers to avoid unnecessary stops at weigh stations and my continued amazement at the low prices that I encounter when I ship my Christmas packages each year with our private-sector partners. These are a few of the reasons that I am thrilled with the progress of the Advantage I-75 program.

Let me describe a few of the products that we will begin to see in the near future from Commercial Vehicle Operations:

- In 1991 and 1992, we can expect to see the installation and operation of the first commercial vehicle information networks. As you are probably aware, your state is already experimenting on a very small scale with the use of AVI equipment. A member of my staff recently received a report that representatives of the Teamsters' Union were inquiring about the legality of "some of those trucks that are bypassing weigh stations in Kentucky." It is only a short step to the next logical question which will be, "Well, how can I get one of those transponders for our trucks?" In 1992, we hope to be installing scanners along the interstate in all the I-75 states.

- By 1993 and 1994, we hope to have specifications developed for centralized purchasing of permits and verification of permits and licenses.

- By 1997, we hope that the motor carrier industry can experience the same transparent borders that you and I enjoy in our personal automobiles as we move from state to state. We also hope to have systems employed on-board our commercial carriers that will monitor driver performance, giving an early warning if drivers are fatigued or otherwise impaired. Finally, we believe that dynamic warning systems are possible in this same time frame to warn of objects in blind-spots or at unsafe distances.

- By the year 2000, we anticipate high-speed weight enforcement and safety inspections. By then, we believe that we can have 100 percent of the interstate system and 50 percent of the National Truck Network instrumented with much of the technological devices we have discussed here.

Benefits occurring from the CVO applications include tremendous savings by the motor carrier industry as a result of increased productivity and in more uniform monitoring. Tremendous savings also will occur for those of us involved in regulatory activities (e.g., fewer new weigh stations). We also will be able to better target efforts (i.e., spend the majority of our time focussing on the minority of carriers that cause our problems rather than spending too much time monitoring the proven "good players.").

IVHS Program Challenges

As with the development of any new idea, there are several challenges that confront us as we work on our "early winners."

- Institutional challenges may be among the most critical. These include multiple political jurisdictions, multiple agencies and disciplines, anti-trust laws (prohibiting collaboration among private sector competitors), and system operation and maintenance.

- Standardization of many components will be required, including vehicle identification, data transmission frequencies, data collection procedures, and the human factors design of the driver interface with the vehicle. We also will need to determine the extent of standardization. Should our system be standardized worldwide, for North America, or for the United States only?

- A key consideration will be system reliability and the potential liability. A high level of system reliability will be required to

assure public acceptance and use. What are the safety risks involved if system failures occur? How will driver safety be assured? What are the responsibilities of government agencies if accidents occur? Will there be limits to the amount of responsibility? How will these issues affect the cost of the system?

- Perhaps the most fundamental question will be that of public acceptance. Will the driver view these technologies as intrusions into his/her privacy? Will drivers allow their vehicles to be controlled? Will passenger and commercial drivers make the investment in navigation equipment, and other safety/warning devices?

Partnerships

We will need to work together to overcome our challenges. The public sector cannot, and indeed should not, develop IVHS technologies by itself. There are too many industrial, technological, and commercial aspects. Instead, it must be accomplished by cooperative public/private partnerships involving governments (federal, state, and local), universities, industry (automotive, communications, electronics), and trade associations.

- The role of the public sector is to coordinate national efforts, establish standardization, conduct/sponsor research, and conduct/sponsor operational tests. Examples of efforts to date include Pathfinder, PATH, TravTek, the Smart Corridor, etc.

- The role of the private sector is to conduct research, develop hardware (designing actual systems), test products (warning and information systems, AVI, etc.), and promote products ("sell" the system components to the public). Examples of efforts to date include anti-lock brakes, cruise control, etc.

- Most of you are probably aware of a new organization, IVHS-America (the Intelligent Vehicle Highway Society of America), that will serve as a focal point for resolving public-private issues. Membership includes companies and corporations, associations, federal, state, and local governments, universities, international organizations, and other public and private organizations.

- IVHS-America will serve as a national forum for communications, coordination, and review of IVHS program needs and progress.

- FHWA will be working closely with IVHS-America to develop a national IVHS program. Also, IVHS-America has been established as a utilized Federal Advisory Council to FHWA to help develop federal program goals and activities.

Summary

Let me end by summarizing the areas we have covered:

- We are entering a new, exciting era for highway-related research and development efforts.
- Major areas of national concern, including safety, structures, pavement, technical training, and congestion management, will be addressed.
- We know we have major problems to contend with in congestion and safety. We have increasing demands on today's highway system, resulting in gridlock in many areas, and increasing economic and environmental concerns.
- We've discussed ***one*** possible solution that was identified in the President's National Transportation Policy—IVHS. We believe that three "early winners" in the IVHS program will be Advanced Traffic Management Systems, Advanced Traveler Information Systems, and particularly Commercial Vehicle Operations. When combined, these systems will offer many potential benefits.
    - **Increased Safety:** By 2010 (only ***20*** years from now) an estimated 11,500 lives could be saved and 442,000 injuries prevented annually.
    - **Reduced Congestion:** Improved travel times, improved air quality, and greatly improved economic productivity could be realized.
- There are many challenges to meet, including technological, institutional, public acceptance, and others.
- Public/private partnerships are an absolute necessity to achieving our goal. The IVHS-America organization is an excellent first step to aid in the coordination of future efforts.

I would like to end with a challenge presented by Dr. Tom Larson, our FHWA Administrator, at the International Conference on Traffic Congestion and Safety (ITE Conference, March, 1990):

> *"We need more than just technical competence. We need new ideas. We need creativity. And, we need the courage to take risks..... You cannot create without commitment. You cannot do without daring.... We have much work to do for America. Let's pull together to get the job done."*